Chapter 300

Bases - 13

This chapter is not part of the Project's specifications, but is a guide for project personnel in interpreting CDOT specifications, understanding ASTM, AASHTO and Colorado test procedures (CPs), and for completing CDOT forms.

The design and construction of a pavement structure may include one or more base courses. A base course is a layer of material below the wearing surface of a pavement. Bases may be constructed of gravels, mixtures of soil and aggregate, mixtures of asphalt and aggregate, mixtures of cement and aggregate or soil, or other innovative materials. Bases may be made of unbound materials, such as gravel, or bound materials, such as lime treated subgrade.

Base courses under concrete pavements provide a drainage layer, reduce pumping, provide protection against frost damage, and provide support for the heavy equipment used for placing concrete pavements. There is some increase in structural capacity when a base is placed under a concrete pavement, but it is typically not a significant amount.

Base courses under flexible pavements provide a significant increase in structural capacity. Pavement design of flexible pavement depends on the wheel loads being distributed over a greater area as the depth of the pavement structure increases. There are the added benefits of improved drainage and protection against frost damage.

ITEM 206 STRUCTURE BACKFILL
ITEM 304 AGGREGATE BASE COURSE

Compaction of unbound bases is important for the stability of the pavement it supports. The maximum dry density is established in the laboratory before construction. During construction measurements of the base dry density are compared to the maximum dry density. The requirements for compaction of aggregate base course (ABC) are shown in Subsection 304.06 of the Standard Specifications for Road and Bridge Construction. Structure Backfill has similar requirements as shown in Subsection 206.03.

Two methods to determine maximum dry density of soils are AASHTO T 99 and AASHTO T 180. AASHTO T 99 is similar to ASTM D 698 and is commonly referred to as the Proctor Test, as it was first proposed by R. R. Proctor in 1933. AASHTO T 99 uses a 5.5 lb. rammer dropped from 12 in. When a 4 in. mold is used, three layers are compacted with 25 blows on each layer. When a 6 in. mold is used, three layers are compacted with 56 blows on each layer. AASHTO T 99 results in a compactive effort of 12,400 ft-lbf/ft^3. AASHTO T 180 is similar to ASTM D 1557 and is commonly referred to as the Modified Proctor Test. AASHTO T 180 uses a 10 lb. rammer dropped from 18 in. When a 4 in. mold is used, five layers are compacted with 25 blows on each layer. When a 6 in. mold is used, five layers are compacted with 56 blows on each layer. This results in a compactive effort of 56,000 ft-lbf/ft^3. Comparing compactive efforts, AASHTO T 180 produces four and a half times the compactive effort than a sample receives compacted according to AASHTO T 99.

AASHTO T 99 is the appropriate standard for compaction of cohesive soils, particularly if there is the potential for swelling when saturated. AASHTO T 180 is appropriate for granular soils, such as aggregate base course and Structure Backfill, Class 1.

There are four methods of determining moisture-density relationships by AASHTO T 180:

- Method A uses a 4 in. mold and the fraction of the soil passing a No. 4 sieve. AASHTO states that this is applicable to soil mixtures that have 40% or less retained on a No. 4 sieve.

- Method B uses a 6 in. mold and the fraction of the soil passing a No. 4 sieve. AASHTO

states that this is applicable to soil mixtures that have 40% or less retained on a No. 4 sieve.

- Method C uses a 4 in. mold and the fraction of the soil passing a 3/4 in. sieve. AASHTO states that this is applicable to soil mixtures that have 30% or less retained on a 3/4 in. sieve.

- Method D uses a 6 in. mold and the fraction of the soil passing a 3/4 in. sieve. AASHTO states that this is applicable to soil mixtures that have 30% or less retained on a 3/4 in. sieve.

The gradation requirements for Class 1 Structure Backfill and ABC are shown in Subsections 703.08 and 703.03 respectively. A review of the gradation requirements shows that many granular materials will meet the gradation requirements and exceed the limits of application stated in AASHTO T 180.

Colorado has developed a rock correction formula in Colorado Procedure 23 (CP 23) when AASHTO T180 is used:

$$MDD = (P_f \times D_f + P_c \times 0.95\ D_c) / 100$$

The standard practice within the Department follows:

- 110 lbs. of granular material are sampled and sent to the laboratory before construction begins. This would typically require two standard sample bags.
- The material is separated into two fractions, material retained on a No. 4 sieve and material passing a No. 4 sieve.
- The specific gravity and absorption of the material retained on a No. 4 sieve is determined according to AASHTO T 85 Specific Gravity and Absorption of Coarse Aggregate.
- The maximum dry density and optimum moisture of the material passing a No. 4 sieve is determined according to AASHTO T 180, Method A.
- For bases with crushed concrete or reclaimed asphalt pavement (RAP), an accurate specific gravity determination is difficult to make. For these materials T 180, Method D is used.
- Method D may be used if more than 30% of the material is retained on the No. 4 sieve, but has 30% or less of the material retained on the ¾ inch sieve. When Method D is used, use the above procedure but substitute the 3/4 inch sieve for the No. 4 sieve.

During construction the control of compaction follows according to the plans, specifications, and the Frequency Guide Schedule for Minimum Materials Sampling, Testing and Inspection. Each field test must include a separation of the sample into the two fractions, material retained on a No. 4 sieve and material passing a No. 4 sieve. Percent relative compaction is determined according to CP 25. CP 23 is used to correct the maximum dry density and optimum moisture for soil-rock mixtures with more than 5% material retained on a No. 4 sieve.

ITEM 308 PORTLAND CEMENT & FLY ASH

Sources of portland cement and/or fly ash are listed on the Department's Approved Product List. To verify a specific cementitious material that may be considered for a project check if the supplier / manufacturer of the cement or fly ash is on the Approved Products List at the web site address of:

www.coloradodot.info/business/APL/ .

If a manufacturer wants to add a cement or fly ash source use the same web site and follow the instructions within Notice to Manufacturers and also follow all references within CP 11.

CDOT Forms - Applicable for Bases, Examples and Instructions

COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☒ no

Field sheet No.	Date
120227	5/6/02

Project No.	Project location
IM 0253-151	I-25, SH 7 to WCR 16

Project code (SA#)	Function	Region	Part.
11925	3200	4	P

Sample submitted: (ie.: Soil, ABC, Hydrated lime, HMA, concrete cores, steel, etc.) **Structure Backfill**

Field office phone number: 303-828-0386
Field office FAX number: 303-828-0430

Item	Class	Grading	Special provisions applicable:
206	1		☒ yes ☐ no

Previously used on Project No.:

Previous CDOT Form #157 F/S No.(s):

☒ CDOT Form #633 (sack)
☐ CDOT Form #634 (can)

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided, etc.

Submitting (2) sacks of Structure Backfill material.

Perform the following tests for compliance w/Specifications.

Gradation

Atterberg Limits

M/D Curve W/Rock Correction

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☒ Maintenance ☐ Emergency ☐

Date needed: ASAP

Contractor: Kraemer and Sons

Supplier: Kraemer and Sons

Sampled from (Pit, roadway, windrow, stock, etc.): Stockpile

Pit name or owner: Varra

Quantity represented	Previous quantity	Total quantity to date
1/source/project	N/A	N/A

Sample submitted:	Shipped to:	Via	Date
☒ Yes ☐ No	☒ Central lab ☐ Region lab	Geocal	5/6/02

Sampled or inspected by (Name)	(Title)	Lab phone number
Raymie Parington	Technician	720-371-0767

Supervisor (Pro./Res./Matls. Engr./Maint. Supt.)	Title	Address
Corey Stewart	P.E. I	1050 Lee Hill Rd. Boulder, Co. 80302

Distribution: White copy - Staff Materials Branch
(submit white copy only if sample or information is directed to Staff Materials)
Canary copy - Region Materials Engineer
Pink copy - Resident Engineer

Previous editions may be used until supplies are exhausted

CDOT Form #157 9/07

CDOT Form #157

Note: Within Date needed, ASAP is not a date.

COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☒ no

Field sheet No.	Date
120227	1/2/02

Project No.	Project location
IM0253-151	I-25, SH 7 to WCR 16

Project code (SA#)	Function	Region	Part.
11925	3200	4	P

Sample submitted: (ie.: Soil, ABC, Hydrated lime, HMA, concrete cores, steel, etc.) **Filter Material**

Field office phone number: 303-828-0386
Field office FAX number: 303-828-0430

Item	Class	Grading	Special provisions applicable:
206	A		☒ yes ☐ no

Previously used on Project No.:

Previous CDOT Form #157 F/S No.(s):

☒ CDOT Form #633 (sack)
☐ CDOT Form #634 (can)

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided, etc.

Submitting (1) sack of Filter Material (Class A).

Test For Gradation

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☒ Maintenance ☐ Emergency ☐ Date needed: ASAP

Contractor	Supplier
Kraemer and Sons	Pipeline Construction

Sampled from (Pit, roadway, windrow, stock, etc.)	Pit name or owner
Stock	Varra Co. Pit #115

Quantity represented	Previous quantity	Total quantity to date
1/source/project	N/A	1/source/project

Sample submitted:	Shipped to:	Via	Date
☒ Yes ☐ No	☒ Central lab ☐ Region lab	CDOT	1/3/02

Sampled or inspected by (Name)	(Title)	Lab phone number
Fidel Gonzalez	E/PS Tech II	303-828-2644

Supervisor (Pro./Res./Matls. Engr./Maint. Supt.)	Title	Address
Corey Stewart	P.E. I	1050 Lee Hill Rd. Boulder, Co. 80302

Distribution: White copy - Staff Materials Branch
(submit white copy only if sample or information is directed to Staff Materials)
Canary copy - Region Materials Engineer
Pink copy - Resident Engineer

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COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☐ no

Field sheet No.	Date
210351	10/04/2002

Project No.	Project location
IM-0253-151	I-25, SH 7 to WCR 16

Project code (SA#)	Function	Region	Part.
11925	3200	4	P

Sample submitted: (ie.: Soil, ABC, Hydrated lime, HMA, concrete cores, steel, etc.) **Aggregate Base Course**

Field office phone number: **303-828-0386**

Field office FAX number: **303-828-0430**

Item	Class	Grading	Special provisions applicable
304	6		☒ yes ☐ no

Previously used on Project No.:

Previous CDOT Form #157 F/S No.(s):

☒ CDOT Form #633 (sack)
☐ CDOT Form #634 (can)

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided, etc.

Submitting (6) sacks of 304 ABC Class 6 for:

***Gradation**

***R Value (min 78)**

***T180 Method D**

***Atterberg Limits**

As per project specials and the CDOT FMM.

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☒ Maintenance ☐ Emergency ☐

Date needed: **10/11/2002**

Contractor: **Kraemer and Sons**

Supplier: **Hamms Operation**

Sampled from (Pit, roadway, windrow, stock, etc.): **Benched Stockpile**

Pit name or owner: **Hamms Operation**

Quantity represented	Previous quantity	Total quantity to date
1/source/project	1/source/project	1/source/project

Sample submitted: ☒ Yes ☐ No

Shipped to: ☒ Central lab ☐ Region lab

Via: **Geocal**

Date: **10/04/2002**

Sampled or inspected by (Name)	(Title)	Lab phone number
Dave Buck	Q. A. Tech	303-828-2644

Supervisor (Pro./Res./Matls. Engr./Maint. Supt.)	Title	Address
Corey Stewart	P. E. I	1050 Lee Hill Rd. Boulder, Co. 80302

Distribution: White copy - Staff Materials Branch
(submit white copy only if sample or information is directed to Staff Materials)
Canary copy - Region Materials Engineer
Pink copy - Resident Engineer

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COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☒ no

Field sheet No.	Date		
120227	7/28/03		
Project No.	Project location		
IM0253-151	I-25, SH 7 to WCR 16		
Project code (SA#)	Function	Region	Part.
11925	3200	4	P

Sample submitted: (ie.: Soil, ABC, Hydrated lime, HMA, concrete cores, steel, etc.) **Aggregate Base Course**

Field office phone number: 303-828-0386
Field office FAX number: 303-828-0430

Item	Class	Grading	Special provisions applicable: ☒ yes ☐ no
304	6		

Previously used on Project No.:

Previous CDOT Form #157 F/S No.(s):

☒ CDOT Form #633 (sack)
☐ CDOT Form #634 (can)

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided, etc.

Submittin (2) sacks of Aggregate Base Course to be tested as follows:

Gradation, (CP-31), Atterberg Limits, (T-89 and T-90).

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☒ Maintenance ☐ Emergency ☐

Date needed: ASAP

Contractor	Supplier
Kraemer and Sons	Cat Construction
Sampled from (Pit, roadway, windrow, stock, etc.): Belt	Pit name or owner: Goose Haven

Quantity represented	Previous quantity	Total quantity to date
2000 Tons	4000 Tons	6000 Tons

Sample submitted:	Shipped to:	Via	Date
☒ Yes ☐ No	☒ Central lab ☐ Region lab	Geocal	7/30/03

Sampled or inspected by (Name)	(Title)	Lab phone number
R. Partington	Technician	303-828-2644

Supervisor (Pro./Res./Matls. Engr./Maint. Supt.)	Title	Address
Corey Stewart	P.E. I	1050 Lee Hill Rd. Boulder, Co. 80302

Distribution: White copy - Staff Materials Branch
(submit white copy only if sample or information is directed to Staff Materials)
Canary copy - Region Materials Engineer
Pink copy - Resident Engineer

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CDOT Form #157 9/07

CDOT Form #157

Note: Within Date needed, ASAP is not a date.

COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☒ no

Field sheet No.	Date		
120227	7/9/03		
Project No.	Project location		
IM0253-151	I-25, SH 7 to WCR 16		
Project code (SA#)	Function	Region	Part.
11925	3200	4	P

Sample submitted: (ie.: Soil, ABC, Hydrated lime, HMA, concrete cores, steel, etc.) **Hydrated Lime**

Field office phone number: 303-828-0386
Field office FAX number: 303-828-0430

Item	Class	Grading	Special provisions applicable: ☒ yes ☐ no
307			

Previously used on Project No.:

Previous CDOT Form #157 F/S No.(s):

☐ CDOT Form #633 (sack)
☒ CDOT Form #634 (can)

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided, etc.

Submitting one can of Hydrated Lime for Gradation.

CTR for chemical testing is retained in the project

files and a copy was sent to the Region 4 Materials Engineer

for review. This lime is listed on CDOT's QML.

mix #142010

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☒ Maintenance ☐ Emergency ☐ Date needed: ASAP

Contractor	Supplier
Kraemer and Sons	Pete Lein
Sampled from (Pit, roadway, windrow, stock, etc.): Hopper	Pit name or owner: Distel Plant

Quantity represented	Previous quantity	Total quantity to date
1st 10 K	0	1st 10K

Sample submitted:	Shipped to:	Via	Date
☒ Yes ☐ No	☒ Central lab ☐ Region lab	Geocal	7/9/03

Sampled or inspected by (Name)	(Title)	Lab phone number
D. Elsbernd	QA Tech	303-828-2644
Supervisor (Pro./Res./Matls. Engr./Maint. Supt.)	**Title**	**Address**
Corey Stewart	P.E. I	1050 Lee Hill Rd. Boulder, Co. 80302

Distribution: White copy - Staff Materials Branch (submit white copy only if sample or information is directed to Staff Materials)
Canary copy - Region Materials Engineer
Pink copy - Resident Engineer

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CDOT Form #157 9/07

CDOT Form #157

Note: Within Date needed, ASAP is not a date.

COLORADO DEPARTMENT OF TRANSPORTATION
FIELD TESTS OF BASE AGGREGATES, FILLERS, PAVING AND MISCELLANEOUS AGGREGATES

Project No. IM 0253-151	Field sheet # 120997
Project code (SA#) 11925 — Region 4	Item # (Check appropriate item below) 304
Proj. location I-25, SH 7 to WCR 16	Date 7/7/03

Test #	Date 20 03	Station taken	Tons (t) or Yards (m)	Field density	Lab max density	% Rel. Comp.	Total moist.	2" (50mm)	1½" (37.5mm)	1" (25.0mm)	¾" (19.0mm)	#4	#8	#30	#50	#100	#200	L.L.	P.I.
1	7/5	Belt Cut	2000	134.1	136.2	98.5	2.5	100	100	100	100	59	48	28	19	13	8.2	18	2
2	7/7	Belt Cut	2000	134.9	138.8	97.2	2.7	100	100	100	100	61	50	30	21	14	9.1	19	3
		Sheet Total	4000	Specifications:						100	90-100	61-71	44-54	18-26			3.1-71		
		Previous Total	0																
		Total to Date	4000																

Final report: ☐ yes ☒ no

Spec. deviations: ☒ yes ☐ no

P=________ % for lot # ________

Items:
206 Structure Backfill Class 1 ______
206 Filter Material Class ______
304 ABC Class ______
307 Filler Type ______
403 HBP Grading S(75)
409 Cover Coat ______
410 Plant Mix SC Type ______
Other Material:

Remarks

Action taken:

Source (pit): Agg. Industries

Tester: Fidel Gonzales	Title: E/PS Tech III
Approved by: Corey Stewart	Title: P.E. I

Distribution: Original - Project File

Previous editions are obsolete and may not be used

CDOT Form #6 4/04

CDOT Form # 6, Gradation

COLORADO DEPARTMENT OF TRANSPORTATION

FIELD TESTS OF BASE AGGREGATES, FILLERS, PAVING AND MISCELLANEOUS AGGREGATES

Project No. IM 0253-151 | Field sheet # 120777

Project code (SA#) 11925 | Region 4 | Item # (Check appropriate item below) 304

Proj. location I-25, SH 7 to WCR 16 | Date 12/27/03

Test #	Date 20___	Station taken	Tons (t) or Yards (m)	Field density	Lab max density	% Rel Comp	Total moist.	2" (50mm)	1½" (37.5mm)	1" (25.0mm)	¾" (19.0mm)	#4	#8	#30	#50	#100	#200	L.L.	P.I.
1	12/20	100+05	2000	123.9	130.0	95.3	2.5												
2	12/26	400+95	2000	124.1	130.0	95.5	2.7												

		Specifications:
Sheet Total	4000	
Previous Total	0	
Total to Date	4000	

Final report: ☐ yes ☒ no

Spec. deviations: ☐ yes ☐ no

P=_____% for lot #_____

Items:
206 Structure Backfill Class 1 _____
206 Filter Material Class _____
304 ABC Class 6
307 Filler Type _____
403 HBP Grading _____
409 Cover Coat _____
410 Plant Mix SC Type _____
Other Material:

Remarks

Action taken:

Source (pit): Varra

Tester: F. Gonzalez | Title: E/PS Tech III

Approved by: C. Stewart | Title: P.E. I

Distribution: Original - Project File

Previous editions are obsolete and may not be used

CDOT Form #6 4/04

Colorado Department of Transportatio
AGGREGATE TEST REPORT

Field Sheet No: 149102
Date Submitted 12/23/2003
Item Number: 304

Project ID: 11925
Project: IM 0253-151
Location: SH 7 to WCR 16
Date Sent: 12/24/2003
Pit Owner: DUNES PARK
Region: 04

Aggregate Test Report

Sampled From: WINDROW
Materials Description: CLASS 3 ABC
Central Lab Test No.: 2003937X
Project ID:

				SPECIFICATIONS			
(Grading AASHTO - T27)							
Passing	6	Inch	100%		6	Inch	(152.4 mm)
Passing	4	Inch	100%		4	Inch	(101.6 mm)
Passing	3	Inch	100%		3	Inch	(76.2 mm)
Passing	2 1/2	Inch	100%		2 1/2	Inch	(63.5 mm)
Passing	2	Inch	86%		2	Inch	(50.8 mm)
Passing	1 1/2	Inch	80%		1 1/2	Inch	(38.1 mm)
Passing	1	Inch	72%		1	Inch	(25.4 mm)
Passing	3/4	Inch	67%		3/4	Inch	(19.0 mm)
Passing	1/2	Inch	61%		1/2	Inch	(12.7 mm)
Passing	3/8	Inch	57%		3/8	Inch	(9.51 mm)
Passing	#4		47%		#4		(4.75 mm)
Passing	#8		35%		#8		(2.36 mm)
Passing	#16		23%		#16		(1.18 mm)
Passing	#30		14%		#30		(600 mu)
Passing	#50		7%		#50		(300 mu)
Passing	#100		4%		#100		(150 mu)
Passing	#200		3.3%	20 MAX.	#200		(75 mu)

Fractured Faces (CP45):
Abrasion (%Wear) (T96)::
Liquid Limit (T89): NV
Plastic Limit (T90):
Plastic Index (T90): NP
"R" Value (T190):

* Indicates Deviation from Specification Requirements.

Fine Aggregate	Bulk sp.g.:	App. sp.g.:	% Abs.:
Course Aggregate	Bulk sp.g.:	App. sp.g.:	% Abs.:

Remarks:

cc:
Central Laboratory
Regional Materials Engineer

Glenn Frieler
Concrete/ Physical Properties Program Manager

CDOT FORM # 38
1/2000

COLORADO DEPARTMENT OF TRANSPORTATION
STRUCTURE BACKFILL DENSITY REPORT

Project No.	IM 0253-151
Proj. location	I-25, SH 7 to WCR 16
Date	2/14/03
Region	4
Project code (SA#)	11925

Major Structures

Number of Structures: (1 test/200 cu. yds.; minimum 1/structure) 2	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 1910	1350	7	560	3

Cross Drains

Number of Cross Drains: (1 test/200 cu. yds.; minimum 1/structure) 8	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 1800	1800	10		

Side Drains

Number of Side Drains: (1 test/200 cu. yds.; minimum 1/structure) 6	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 750	450	6	300	6

Other

	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests

Remarks

Signed	Title
Fidel Gonzalez	E/PS Tech III

☐ Resident Engineer, ☐ Materials & Geotechnical Branch (Documentation Unit)

CDOT Form #194 3/04

COLORADO DEPARTMENT OF TRANSPORTATION
SOILS AND AGGREGATES SIEVE ANALYSIS
WHEN SPLITTING ON THE No. 4 SIEVE

Project no. IM 0253-151
Project code (SA#) 11925
Item 304 Class 1

Pit name Goose Haven | Station 385+80 | Test no. 3 | Sample weight 49.70 | Date 10/10/03

Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs
2 1/2	——	——	0.0		100.0	100
2	——	——	0.0		100.0	95-100
1 1/2	1.92	1.87	3.9		96.1	
1	10.28	10.01	20.8		75.3	
3/4	4.26	4.15	8.6		66.7	
1/2	4.24	4.13	8.6		58.1	
3/8	1.57	1.53	3.2		54.9	
+ #4	4.83	4.70	9.8		45.1	30-60
- #4	22.60	21.67	45.1	# 8	40.2	
Total	49.70	48.06	100.0	# 50	17.5	
				#200	9.3	5-12

Liquid limit: NV
Plastic limit: NP
Plastic index: NP
Soil class.: N/A
"R" value: 80
Sampled by:
Tested by:

Moisture correction
Plus #4 moisture sample
Wet weight 1587.0
Dry weight 1545.0
Loss 42.0
% moisture 2.7
Minus #4 moisture sample
Wet weight 584.0
Dry weight 560.0
Loss 24.0
% moisture 4.3

Minus #4 wash

Wet weight (grams): 560

Sieve	Weight (grams)	Individual percentage		Percent passing
# 8	61	10.9		89.1
# 50	282	50.3		38.8
#200	101	18.1		20.7
- #200	116	20.7		
Total	560	100.0		

Dry weight (grams): 560

Weighing Individually

NOTE: Save all material until calculations are completed in case a check is necessary

Pit name | Station | Test no. 3 | Sample weight 49.70 | Date 10/10/03

Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs
2 1/2	——	——	0.0		100	100
2	——	——	0.0		100	95-100
1 1/2	1.92	1.87	3.9		96.1	
1	12.20	11.88	24.7		75.3	
3/4	16.46	16.03	33.3		66.7	
1/2	20.70	30.16	41.9		58.1	
3/8	22.27	21.68	45.1		54.9	
+ #4	27.10	26.39	54.9		45.1	30-60
- #4	22.60	21.67	45.1	#	40.2	
Total	49.70	48.06	100	#	17.5	
				#200	9.3	5-12

Liquid limit: NV
Plastic limit: NP
Plastic index: NP
Soil class.: N/A
"R" value: 80
Sampled by:
Tested by:

Moisture correction
Plus #4 moisture sample
Wet weight 1587.0
Dry weight 1545.0
Loss 42.0
% moisture 4.3
Minus #4 moisture sample
Wet weight 584
Dry weight 560
Loss 24
% moisture 4.3

Minus #4 wash

Wet weight (grams): 560

Sieve	Weight (grams)	Individual percentage		Percent passing
# 8	61	10.9		89.1
# 50	343	61.2		38.8
#200	444	79.3		20.7
- #200	116	20.7		
Total	560	100.0		

Dry weight (grams): 560

Weighing Accumulatively

Page 1 of 2 CDOT Form #564 4/07

CDOT Form # 564 Dry

COLORADO DEPARTMENT OF TRANSPORTATION
SOILS AND AGGREGATES SIEVE ANALYSIS WHEN SPLITTING ON THE No. 4 SIEVE

Project no. IM 0253-151
Project code (SA#) 11925
Item 304 Class 1

Pit name Goose Haven | Station 410+10 | Test no. 4 | Sample weight 22.35 | Date 10/10/03

Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs
2 1/2		—	—		100	100
2		0.66	3.0		97.0	95-100
1 1/2		3.32	15.0		82.0	
1		1.44	6.5		75.5	
3/4		1.62	7.3		68.2	
1/2		2.58	11.7		56.5	
3/8		1.48	6.7		49.8	
+ #4		1.05	4.8		45.0	30-60
- #4	10.20	9.95	45.0	#8	37.9	
Total	22.35	22.10	100.0	#50	24.9	
				#200	7.2	5-12

Liquid limit NV
Plastic limit NP
Plastic index NP
Soil class. N/A
"R" value 80
Sampled by
Tested by

Moisture correction
Plus #4 moisture sample
Wet weight
Dry weight
Loss
% moisture
Minus #4 moisture sample
Wet weight 490.0
Dry weight 478.0
Loss 12.0
% moisture 2.5

Minus #4 wash

Wet weight (grams)

Dry weight (grams) 478

Sieve	Weight (grams)	Individual percentage		Percent passing
# 8	75	15.7		84.3
# 50	138	28.9		55.4
#200	189	39.5		15.9
- #200	76	15.9		
Total	478	100.0		

Weighing Individually

NOTE: Save all material until calculations are completed in case a check is necessary

Pit name Goose Haven | Station 410+10 | Test no. 4 | Sample weight 22.35 | Date 10/10/03

Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs
2 1/2		—	—		100	100
2		0.66	3.0		97.0	95-100
1 1/2		3.98	18.0		82.0	
1		5.42	24.5		75.5	
3/4		7.04	31.8		68.2	
1/2		9.62	43.5		56.5	
3/8		11.10	50.2		49.8	
+ #4		12.15	55.0		45.0	30-60
- #4	10.20	9.95	45.0	#8	37.9	
Total	22.35	22.10	100.0	#50	24.9	
				#200	7.2	5-12

Liquid limit NV
Plastic limit NP
Plastic index NP
Soil class. N/A
"R" value 80
Sampled by
Tested by

Moisture correction
Plus #4 moisture sample
Wet weight
Dry weight
Loss
% moisture
Minus #4 moisture sample
Wet weight 490.0
Dry weight 478.0
Loss 12.0
% moisture 2.5

Minus #4 wash

Wet weight (grams)

Dry weight (grams) 478

Sieve	Weight (grams)	Individual percentage		Percent passing
# 8	75	15.7		84.3
# 50	213	44.6		55.4
#200	402	84.1		15.9
- #200	76	15.9		
Total	478	100.0		

Weighing Accumulatively

CDOT FORM # 565 INSTRUCTIONS

This form is a field work sheet for use when testing aggregates in accordance with CP 31 when the maximum nominal particle size is less than 3/4 in.

This procedure allows for the total dry weight (mass) of the specimen, before washing, to be determined by either drying the total specimen or correcting it to dry weight (mass) using a moisture specimen of the same gradation and approximate weight (mass) as the specimen for wash.

Example No. 1 illustrates using a separate moisture specimen to correct the wet weight (mass) of the wash specimen to dry weight (mass).
Example No. 2 illustrates drying the total specimen to be washed and sieved. The percent moisture may be calculated if desired.

When correcting to dry weight (mass) by the use of a moisture specimen, it is very important that the specimen for wash and the specimen for moisture be taken and weighed at the same time. It is also important that the samples be as nearly identical in weight (mass) and gradation as possible.

NOTE: CDOT Form #565 was revised on 01/2013. The example still depicts the previous revision date of 4/07.

COLORADO DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS FOR AGGREGATES NOT SPLIT ON THE No. 4 SIEVE

Project no. IM 0253-151 | Project code (SA#) 11925
Proj. location I-25 SH 7 to WCR 16
Pit name Goose Haven
Item 203 | Class R-50 (spec)

Station	2588+15 13' lt.	Test #	13	Station	3000+00 5' rt	Test #	14
Specimen wt (dry) B	772.2	Date	6/5/02	Specimen wt (dry) B	15962.9	Date	6/5/03

Sieve	Weight	Percent retained	Percent passing	Specs	Sieve	Weight	Percent retained	Percent passing	Specs
2"1					2"1	341.1	2.1	97.9	
1 1/2"					1 1/2"	758.1	4.7	93.3	
1"					1"	1617.7	10.1	89.9	
3/4"					3/4"	2103.2	13.2	86.8	
1/2"					1/2"	2698.7	16.9	83.1	
3/8"					3/8"	2967.9	18.6	81.4	
#4	0.3	0	100		#4	3503.7	21.9	78.1	
#10	39.8	5.2	94.8		#10	4150.4	26.0	74.0	
#16	84.8	11.0	89.0		#16	4868.7	30.5	69.5	
#40	258.2	33.4	66.6		#40	7662.2	48.0	25.0	
#50	379.0	49.1	50.9		#50	9609.7	60.2	39.8	
#100	577.9	74.8	25.2		#100	12818.2	80.3	19.7	
#200	668.6	86.6	13.4		#200	14286.8	89.5	10.5	
-#200	5.7				-#200	10.5			
TOTAL	674.3				TOTAL	14297.3			

	Gradation Sample	Moisture Sample		Gradation Sample	Moisture Sample
Pan ID			Pan ID		
Pan weight			Pan weight		
Wet weight + Pan			Wet weight + Pan		
Wet weight	A	702.6	Wet weight	A	702.2
Dry weight + Pan			Dry weight + Pan		
Dry weight	B	650.6	Dry weight	B	650.1
Dry wash weight / H_2O Loss		52.0	Dry wash weight / H_2O Loss		52.1
-#200 / % H_2O		8.0	-#200 / % H_2O		8.0

Wet weight ÷ (100 + % H_2O) x 100 = Dry weight

A 834.0 ÷ (100 + 8.0) x 100 = B 772.2

A 17239.9 ÷ (100 + 8.0) x 100 = B 15962.9

Sampled by	Tested by	Sampled by	Tested by
Dave Buck	John Assad	Dave Buck	John Assad

NOTE: Save all material until calculations are complete in case check is necessary.

CDOT Form #633, Materials Sample Tag
Revision Date 05/2013
Actual required size 8" x 2 5/8" with a detachable stub and with a wire tie through a reinforced hole located on left side of the tag so as to attach to cans, bags, etc.
Paper stock as used in the past.

The example below is not to scale.

Contract ID # (Project Code) **11925** Material Code **403.02.0121**	Contract ID # **11925**
Sample ID # FS # **120027** Test # **4A**	Sample ID #
Lab Ref. #	FS # **120027** Test # **4A**
Item # **403** Container **1** of **8**	Station **Cooley Morrison Quarry 3/4 Rock**
COLORADO DEPARTMENT OF TRANSPORTATION	Depth **5'**
Materials & Geotechnical Branch	Item # **403**
4670 N. Holly St. Denver, Unit A	Container **1** of **8**
Denver, CO 80216-6408 CDOT Form# 633 05/2013	***DETACH STUB AND PLACE IN CONTAINER***

COLORADO DEPARTMENT OF TRANSPORTATION
STABILOMETER RECORD OF ITEM 304 ABC

Project No. IM 0253-151 | Region 4
Project code (SA#) 11925
Proj. location I-25 SH 7 to WCR 16

Pit name: Goose Haven | Date: 3/21/01 | Field sample #: 130152 | Lab #: 13A
Represents: 304 | LL: NV | PL | PI: NP | SE | Class: 6

GRADATION

Sieve size	As run % passing	As run Scalp	Set up
4"			
3"			
2½"			
2"			
1½"			
1"			
3/4"	100	100	
1/2"	89	89	11 %
3/8"	73	73	27 %
#4	47	47	53 %
#8	36		
#16	29		
#50	18		
#100	13		
#200	9		

Stabilometer "R" value: 78

% moisture at ____ lbs. per cu. ft.

% Moisture - #4 Material	0.85	X
Weight of - #4 Material		=
Weight of H_2O		+
Initial H_2O added	50	=
Total initial H_2O		(A)

COMPACTION

Cylinder #	3	4	5
H_2O added (B)	65	75	70
Exudation pressure, lbs	10000	2960	5700
Exudation pressure, PSI	796	236	454
Ht. of briquette (H)	2.41	2.40	2.42
Wt. cylinder & wet sample	3275	3282	3281
Cylinder tare	2115	2117	2116
Wet wt. of sample (W_w)	1160	1165	1165
[1] Weight of H_2O (C)			
[2] Dry wt. (D)			
[3] % Moisture (M)			
[4] Density			
Height correction by wt.			

Set up weights

-3/4" + 1/2"	121
-1/2" + 3/8"	297
-3/8" + #4	583
- #4	1100

[1] (A) + (B) = (C)
[2] (Ww) - (C) = (D)
[3] (C) + (D) = (M)
[4] $\frac{(W_w) \times 30.3}{(100 + M) \times H}$

STABILOMETER

Total load	PSI				
1000	80				
2000	160	15	23	16	
Displacement turns		5.52	4.38	5.24	
"R" value		81(80)	77(76)	81(80)	
Drainage					
Exp. pressure dial reading					

CDOT Form #1126 3/04

COLORADO DEPARTMENT OF TRANSPORTATION
Granular Material Moisture - Density Report

Project ID	11925	**Location**	SH 7 TO WCR 16		
Project	IM 0253-151	**Source**	GOOSE HAVEN	**Report Date**	
F.S. #	98765	**Region**	04	**Construction**	3200
Engineer	Glenn Frieler, Concrete/ Physical Properties Program Manager				
Comments	304 CLASS 6 ABC				

Lab #	Sp. G.	Absorption
2002-0522	2.57	1.3

Lab Tests: Method: T180A

Test	#1	#2	#3	#4	#5
Moisture	4.7	6.7	9.2	11.5	
Dry Density	126.4	130.2	131.1	125.6	

Moisture Chart:

%H2O	Dry Density	%H2O	Dry Density	%H2O	Dry Density	%H2O	Dry Density
5.0	127.1	7.2	130.9	9.4	130.8		
5.1	127.3	7.3	131.0	9.5	130.7		
5.2	127.6	7.4	131.1	9.6	130.6		
5.3	127.8	7.5	131.1	9.7	130.5		
5.4	128.0	7.6	131.2	9.8	130.3		
5.5	128.2	7.7	131.3	9.9	130.1		
5.6	128.4	7.8	131.3	10.0	129.9		
5.7	128.6	7.9	131.4	10.1	129.8		
5.8	128.8	8.0	131.4	10.2	129.6		
5.9	129.0	8.1	131.4	10.3	129.3		
6.0	129.2	8.2	131.4	10.4	129.1		
6.1	129.4	8.3	131.4	10.5	128.9		
6.2	129.5	8.4	131.4	10.6	128.6		
6.3	129.7	8.5	131.4	10.7	128.3		
6.4	129.9	8.6	131.4	10.8	128.1		
6.5	130.0	8.7	131.4	10.9	127.8		
6.6	130.2	8.8	131.3				
6.7	130.3	8.9	131.3				
6.8	130.4	9.0	131.2				
6.9	130.6	9.1	131.1				
7.0	130.7	9.2	131.1				
7.1	130.8	9.3	131.0				

Glenn Frieler

Optimum Moisture : 8.3 **Maximum Dry Density : 131.4**

(CDOT #1296 - 9/2002)

CDOT Form # 1296

COLORADO DEPARTMENT OF TRANSPORTATION

Granular Material Moisture - Density Report

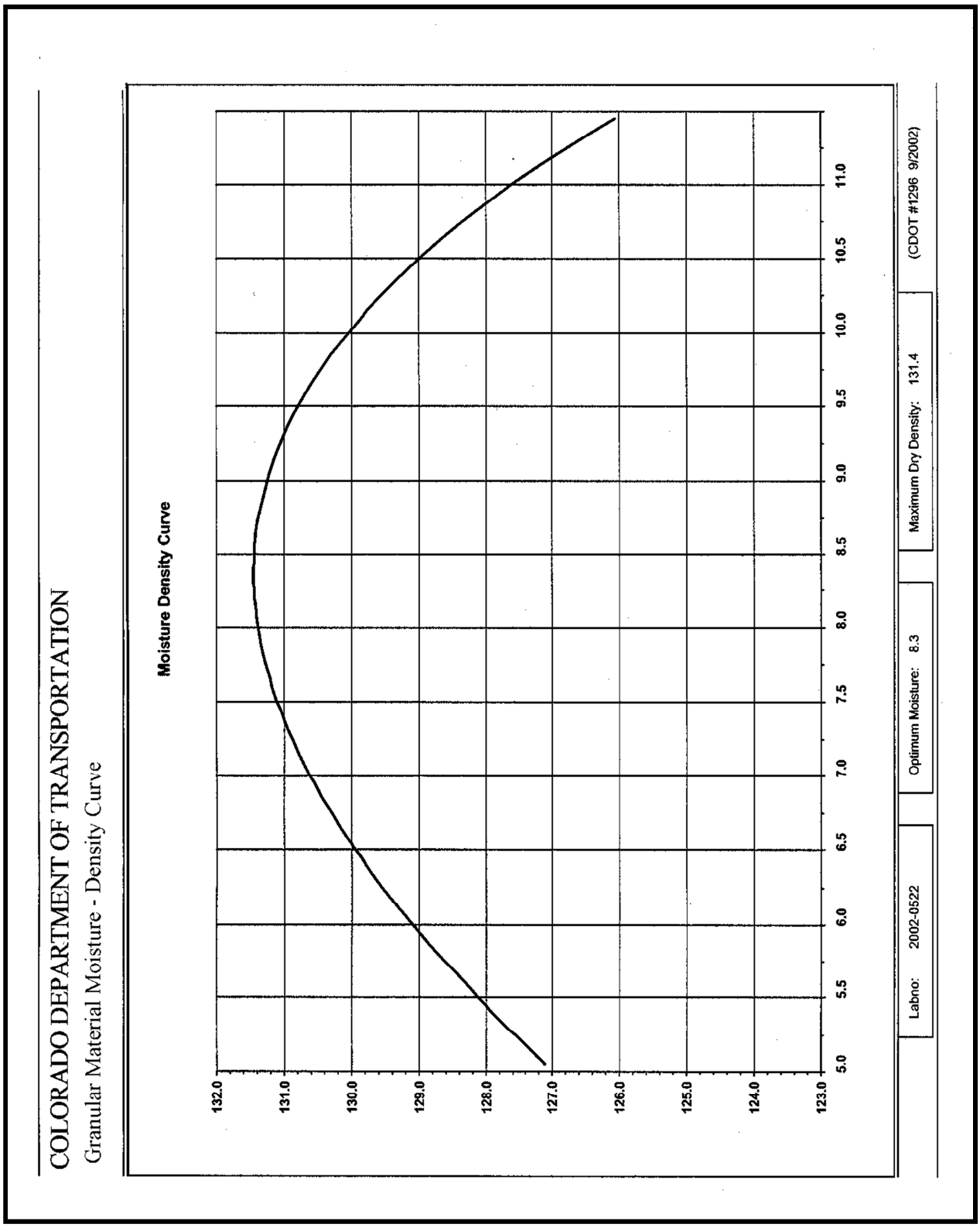
Rock Correction Chart: -4 Material

%+4	%H2O	Dry Density	%+4	%H2O	Dry Density	%+4	%H2O	Dry Density
0	8.3	131.4	20	6.9	134.0	40	5.5	136.6
1	8.2	131.6	21	6.8	134.2	41	5.4	136.7
2	8.2	131.7	22	6.8	134.3	42	5.4	136.9
3	8.1	131.8	23	6.7	134.4	43	5.3	137.0
4	8.0	132.0	24	6.6	134.5	44	5.2	137.1
5	8.0	132.1	25	6.6	134.7	45	5.2	137.2
6	7.9	132.2	26	6.5	134.8	46	5.1	137.4
7	7.8	132.3	27	6.4	134.9	47	5.0	137.5
8	7.8	132.5	28	6.4	135.1	48	4.9	137.6
9	7.7	132.6	29	6.3	135.2	49	4.9	137.8
10	7.6	132.7	30	6.2	135.3	50	4.8	137.9
11	7.5	132.9	31	6.1	135.4	51	4.7	138.0
12	7.5	133.0	32	6.1	135.6	52	4.7	138.1
13	7.4	133.1	33	6.0	135.7	53	4.6	138.3
14	7.3	133.3	34	5.9	135.8	54	4.5	138.4
15	7.3	133.4	35	5.9	136.0	55	4.5	138.5
16	7.2	133.5	36	5.8	136.1	56	4.4	138.7
17	7.1	133.6	37	5.7	136.2	57	4.3	138.8
18	7.1	133.8	38	5.7	136.3	58	4.2	138.9
19	7.0	133.9	39	5.6	136.5	59	4.2	139.0

Optimum Moisture: 8.3

Maximum Dry Density: 131.4

(CDOT #1296 - 9/2002)



CDOT Form # 1296

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